Topic: Transformations algebraically

Question: Choose the correct transformation.

$y = f(x)$ is

shifted down 2 units

shifted to the right 5 units

Answer choices:

A $y = f(x + 5) + 2$

B $y = f(x - 5) - 2$

C $y = f(x + 5) - 2$

D $y = f(x - 5) + 2$

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Solution: B

To transform a function algebraically, the following rules apply.

Shift $y = f(x)$ up by a units	$y = f(x) + a$
Shift $y = f(x)$ down by a units	$y = f(x) - a$
Shift $y = f(x)$ to the right by a units	$y = f(x - a)$
Shift $y = f(x)$ to the left by a units	$y = f(x + a)$
Reflect $y = f(x)$ across the x-axis	$y = -f(x)$
Reflect $y = f(x)$ across the y-axis	$y = f(-x)$
Stretch vertically by a factor of a	$y = af(x)$
Shrink vertically by a factor of a	$y = \frac{1}{a} f(x)$

To solve, first transform $y = f(x)$ by shifting 2 down. Remember to shift $y = f(x)$ down by a units, $y = f(x) - a$. This means that $y = f(x)$ will become

$$y = f(x) - 2$$

Next shift 5 to the right. Remember to shift $y = f(x)$ to the right by a units, $y = f(x - a)$. This means that $y = f(x) - 2$ will become

$$y = f(x - 5) - 2$$

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Topic: Transformations algebraically

Question: Choose the correct transformation.

$y = x^3$ is

shifting up 3 units

reflected across the x-axis

stretched vertically by a factor of 5

Answer choices:

A $y = 5x^3 - 3$

B $y = -5x^3 - 3$

C $y = 5x^3 + 15$

D $y = -5x^3 - 15$

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Solution: D

To transform a function algebraically, the following rules apply.

Shift $y = f(x)$ up by a units	$y = f(x) + a$
Shift $y = f(x)$ down by a units	$y = f(x) - a$
Shift $y = f(x)$ to the right by a units	$y = f(x - a)$
Shift $y = f(x)$ to the left by a units	$y = f(x + a)$
Reflect $y = f(x)$ across the x-axis	$y = -f(x)$
Reflect $y = f(x)$ across the y-axis	$y = f(-x)$
Stretch vertically by a factor of a	$y = af(x)$
Shrink vertically by a factor of a	$y = \frac{1}{a} f(x)$

To solve, first transform $y = x^3$ by shifting up 3 units. Remember to shift $y = f(x)$ up by a units, $y = f(x) + a$. This means that $y = f(x)$ will become

$$y = x^3 + 3$$

Next reflect across the x-axis. Remember to reflect $y = f(x)$ about the x-axis, $y = -f(x)$. This means that $y = x^3 + 3$ will become

$$y = -\left(x^3 + 3\right)$$

$$y = -x^3 - 3$$

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Finally, stretch vertically by a factor of 5. Remember to stretch vertically by a factor of a, $y = af(x)$. This means that $y = -x^3 - 3$ will become

$$y = 5\left(-x^3 - 3\right)$$

$$y = -5x^3 - 15$$

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Topic: Transformations algebraically

Question: Choose the correct transformation.

$y = x^2 - 2$ is

shifted to the left 4 units

reflected across the y-axis

shrunk vertically by a factor of 7

Answer choices:

A $y = \frac{1}{7}x^2 + \frac{26}{7}$

B $y = -\frac{1}{7}x^2 + \frac{26}{7}$

C $y = \frac{1}{7}x^2 - \frac{8}{7}x + 2$

D $y = \frac{1}{7}x^2 + \frac{8}{7}x - 2$

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Solution: C

To transform a function algebraically, the following rules apply.

Shift $y = f(x)$ up by a units	$y = f(x) + a$
Shift $y = f(x)$ down by a units	$y = f(x) - a$
Shift $y = f(x)$ to the right by a units	$y = f(x - a)$
Shift $y = f(x)$ to the left by a units	$y = f(x + a)$
Reflect $y = f(x)$ across the x-axis	$y = -f(x)$
Reflect $y = f(x)$ across the y-axis	$y = f(-x)$
Stretch vertically by a factor of a	$y = af(x)$
Shrink vertically by a factor of a	$y = \frac{1}{a} f(x)$

To solve, first transform $y = x^2 - 2$ by shifting to the left 4 units. Remember to shift $y = f(x)$ to the left by a units, $y = f(x + a)$. This means that $y = x^2 - 2$ will become

$$y = (x + 4)^2 - 2$$

Next reflect across the y-axis. Remember to reflect $y = f(x)$ across the y-axis, $y = f(-x)$. This means that $y = (x + 4)^2 - 2$ will become

$$y = (-x + 4)^2 - 2$$

Finally, shrink vertically by a factor of 7. Remember to shrink vertically by a factor of a, $y = (1/a)f(x)$. This means that $y = (-x + 4)^2 - 2$ will become

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$$y = \frac{1}{7}\left[(-x+4)^2 - 2\right]$$

$$y = \frac{1}{7}\left(x^2 - 8x + 16 - 2\right)$$

$$y = \frac{1}{7}\left(x^2 - 8x + 14\right)$$

$$y = \frac{1}{7}x^2 - \frac{8}{7}x + 2$$

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